

WILLIAM V. GARRISON

Interface Designer
Albert R. Mann Library
Cornell University
Ithaca, New York

Integrating Networked Information into Library Services: Philosophy, Strategy, and Implementation at Mann Library

INTRODUCTION

Until the relatively recent introduction of computer networks into the academic community, the records of scholarship and the collection of the academic library have consisted primarily of physical materials in print-based formats. The publication, distribution, and use of scholarly works are being transformed by the application of computer networking and information technologies. As Hirshon (1993) observes, “since the invention of the printing press, there has been no change so fundamental to the publishing industry as the advent of electronic and networked information” (p. 1). Advances in computing technology have made it possible for digital formats to subsume nearly all previous formats of publication. Text, still and moving images, sounds, music, computer programs, and statistical data—all can be published in a digital format and stored on a computer’s magnetic disk. Wide-reaching computer networks make it possible to distribute those digitally formatted materials to thousands of people within just a few minutes. This transformation from printed to networked information is so profound that we are now considered in the midst of a revolution and paradigm shift, in which the very nature of libraries and librarianship is being challenged (Hirshon, 1993; Lynch, 1992; Malinconico, 1992; Olsen, 1990).

PHILOSOPHY

Mann Library believes that the academic library has a central and critical role to play with regard to networked information in the academic community. Our philosophy is founded on two primary beliefs: first, that the mission of the academic library remains unchanged in the face of changes in publication formats; and, second, that the role of the academic library in the process of scholarship becomes increasingly critical with the emergence of networked scholarly information. The academic library maintains the unique responsibility for providing the academic community with fair and equitable

access to an unbiased collection of intellectual works. The importance of this role to the pursuit of scholarship is without question. "Ideas are the currency of the academy. The free exchange, open criticism, and independent exploration of ideas constitute basic activities of academics" (Duncan, 1993, p. 50). Without fair and equitable access to a complete record of scholarship, there can be no scholarly inquiry and no viable pursuit of truth. The transformation of scholarly publishing from print to digital formats does not change the purpose or mission of the library in the academy.

The traditional mission of the academic library has been to support the activities of research and instruction by providing scholars with access to the records of scholarship. Librarians build collections of scholarly works by identifying, selecting, and preserving items from various disciplines, by organizing and presenting the collection to facilitate its use, and by providing equitable access, assistance, and instruction. These fundamental functions continue in the face of changes in either the formats of publication or the technologies required to accommodate those formats. We believe that networked information resources of relevance to scholarship should be integrated into the collection and services of the academic library.

As Saunders (1992) notes, "technological change is an inherent part of the evolving virtual library" (p. 71). Sophisticated computing and networking technologies are needed for the storage, access, and delivery of networked information resources. Computers have certainly become a more prominent element in academic libraries over the past decade, but the technologies and expertise needed to support networked information resources are not yet commonplace in most. Consequently, many in the academic and library communities have considered what role can be played by campus computing organizations in bringing both informal and scholarly networked information to the academic community (Malinconico, 1992; Martin, 1992; Weber, 1988; Woodsworth, 1988; Post & Sessions, 1986; Neff, 1985). Campus computing organizations have the requisite technical expertise, facilities, and access to the networks and computing technologies necessary to deliver networked information, whereas most libraries currently do not.

Although technology is an important and highly visible component, the infrastructure required to support a collection of networked information resources is comprised of much more. In comparing the library and the campus computing centers, Martin (1992), paraphrasing Moran, observes that "libraries are struggling to incorporate the computer within their long tradition of consistency, while computer centers struggle to develop some consistency in a climate of constant change" (p. 80). Weber also comments that "the academic computer center . . . exists in a volatile entrepreneurial environment with rapidly changing generations of operational technology" (cited in Martin, 1992, p. 78). The entrepreneurial nature of today's academic computing organizations is at odds with that of the library. Any shift away from the library's traditional emphasis on service and public good should raise serious concerns among librarians, administrators, and faculty alike for the provision of fair and equitable access to networked information. The need for technological evolution in the

academic library should not be confused with a need to redefine its role in the academic community. That role remains to support and ensure intellectual freedom in scholarship.

Mann Library believes that the academic library must retain leadership in providing scholars with access to networked information. We have taken the approach that networked information of relevance to scholarship should be integrated into the collection of the academic library. The library must retool its procedures and operations to accommodate this new format of scholarly publication and distribution. Our approach has been guided by the following underlying assumptions (Olsen, 1990, pp. 221-222):

- The fundamental purpose of the campus library remains unique; it continues to be the library's responsibility to connect the scholar with the records of scholarship.
- The records of scholarship will increasingly be stored electronically rather than in print.
- Scholars' microcomputers will become more central to their professional work, which includes the access, use, and retrieval of scholarly information.
- Libraries have a critical stake in the nature of scholars' workstations, as well as the campus, national, and international telecommunications systems that link these machines.
- There is a fundamental difference in the way in which scholars approach and interact with electronic information as opposed to print, which has serious implications for the design of user interfaces to that information.
- Scholars' access to information is not limited by their ability to pay nor by varying degrees of "rights" to access.
- Libraries will continue to share resources even in electronic form.

STRATEGY

In developing a strategy for integrating networked information into library services, Mann Library has, conceptually, approached these information resources as we would scholarly materials published in any nonprint format. While this may seem an oversimplification of an obviously challenging task, this approach has given us a useful framework within which to analyze and address the issues that arise from integrating these resources into the collection. There are five areas of concern that must be addressed when integrating any material in nonprint format into a collection.

Technological Requirements for Storage and Use

Nearly all types of nonprint materials require some technology for their effective use. Videocassettes require a videocassette player and a television set to be viewed; microfiche requires a specialized microfiche reader. To access and retrieve networked information, a person needs a computer, specialized communication software, and a network connection. Specialized software may also be needed to manipulate and manage the information once retrieved (e.g., personal reference managers, spreadsheets, image-processing software). On a

networked campus, many members of the community may already possess the necessary technology to use networked information from their own homes, offices, and laboratories. However, to ensure equitable access for all in the community to the networked information in its collection, a library must provide or otherwise secure public access to networked computers configured with appropriate hardware, software, and peripheral devices.

Unlike other nonprint formats which exist in a physical form, networked information relies on a variety of computer technologies to facilitate its storage. To locally store a digitally formatted information resource for network access, a library would need networked computer, high-capacity disk storage devices, and specialized access and retrieval software. For physical storage of the digitally formatted information, the computer must be equipped with magnetic or optical disks that can range in capacity from a few megabytes to several gigabytes, depending on the size and nature of the resource. The networked computer could range in size from a small personal computer to a large mainframe, depending on the number of patrons for which the library would like to afford simultaneous use of the locally stored information resource. The computer will also need specialized software that can efficiently regulate networked access and provide a user interface with which patrons can interact with the networked information.

Facilities for Storage and Access

Few libraries store their nonprint materials in the stacks along with their books and journals. More often a special facility or area of the library is established where the collection of nonprint materials can be stored near the devices needed to use them. With regard to networked information, its virtual nature obviates the need for access workstations to be housed near the collection. In fact, neither the access workstations nor the collection need be housed in the library at all. A library's collection of networked information can be defined as a virtual one of *accessible* resources that includes information stored locally at the library or remotely at other institutions around the world. Patrons can interact with this collection through any networked computer. It makes little difference to the patron where the networked information resources are actually stored or from where they are accessed—all resources appear equally accessible. Conceptually, the virtual library facility exists wherever a patron has access to a networked computer.

In practice, a library will probably not want the existence of its virtual library to depend on the availability of networked public access computers outside the library or remotely stored information resources from other institutions. To provide in-house access to its collection of networked information, a facility will be needed in a public area of the library to house a collection of networked computer workstations and necessary peripherals. As a library begins to establish a collection of locally stored networked information, facilities for archiving those digitally formatted materials will be needed. Given the complexity and cost of the computing technology needed for storage of networked information, this facility will need to be located in a secure and environmentally controlled area of the library. Unfortunately, the

facilities used for archiving a primarily print-based collection are not adequate for this purpose. A library's archive of digitally formatted materials will need physical facilities that are designed specifically to support the operating requirements of the requisite computing technologies.

Staff Knowledge and Skills

The integration of materials in a new publication format into a library's collection invariably requires changes in staff knowledge and skills. With nonprint formats, new expertise must be acquired to handle both the materials and the devices required to use them. Maintaining and supporting a collection of networked information resources present a particularly challenging demand on staff. To provide a minimal level of assistance to the broadest spectrum of networked patrons, staff must be knowledgeable about the networks, facile in the use of several computing environments (e.g., Macintosh, DOS, and Windows), and comfortable with a wide variety of access software. In addition, staff may need familiarity with a variety of post-processing and information management applications such as spreadsheets, image-processing/graphics software, database programs, and word processors. There must also be staff with technical expertise for managing local networked computer servers and maintaining locally stored information resources.

Changes in Practices of Librarianship

Nonprint materials typically require changes to the manner in which items are collected, cataloged, organized, and presented for access. Existing methods and procedures are modified or new ones developed to accommodate the nonprint format. The selection of nonprint materials for a collection requires the consideration of additional factors not relevant for printed matter, such as compatibility with the library's existing access technology. Nonprint materials often do not contain the "clues" present in print materials, like a title page, table of contents, or an index, and it can be difficult to examine their contents. The presentation of the nonprint collection for public access can also exhibit a problematic fit with existing print-oriented models of circulation. Networked information presents even more challenges to the practices of librarianship.

Many, if not most, users of a library's collection of networked information will not be physically present in the library building. They will be using the library's networked information resources from their homes, offices, classrooms, and laboratories. Reference and instruction librarians must find ways of remaining in contact with these networked patrons to provide assistance, instruction, and information about changes in the collection.

Collection development of networked information is difficult and time-consuming. There does not yet exist a reliable mechanism of communication between publishers of networked information and librarians responsible for selecting those resources for their library's collections. Many of the information resources published on the Internet are announced through networked channels of communication, like online newsgroups and electronic mail discussion lists, that are not usually monitored by collection development staff. Many

publications of networked information are often not announced at all—they just spontaneously appear at the neighborhood archive. Announcements of updates, new versions, or discontinuations are infrequent. Since little descriptive information typically accompanies networked information resources, one must examine them closely to determine if they are of interest and of good quality.

The cataloging and presentation of a collection of networked information resources are also uniquely challenging. It is difficult to create and maintain the accuracy of cataloging records for networked information, particularly those resources that are not stored locally by the library. The same problems faced by collection development librarians—lack of adequate descriptions and unreliability of communication with network publishers—also present challenges to the cataloger. Maintaining accurate records can be time-consuming and labor intensive when the title, content, and even storage location of a networked information resource can change with relatively high frequency and little warning. Adding to this challenge is the fact that the current definitions of cataloging standards such as USMARC and AACR2, and consequently many library cataloging systems, do not readily accommodate the bibliographic description of networked information.

The virtual nature of networked information also has implications for change in the nature of a collection's catalog and in patrons' use of that catalog. In speaking to the use of the traditional collection of physical materials, Hirshon (1993) notes that "access to information was a two-step process, physically represented between the presence of the book on the shelf and the library catalog to help find that book" (p. 2). In contrast, networked information, once located, can be instantly accessed and retrieved. In addition to helping locate an item in the collection, the functionality of an online catalog of a library's collection of networked information will also need to include means of providing direct access to those information resources.

User Instruction

Patrons often require specific instruction from library staff in the handling of nonprint materials. The introduction of networked information and its associated access technologies into the library's collection present the same challenges for user instruction as for staff instruction, except on a larger scale. There will always be more patrons inexperienced with computing technology and networked information than staff. While the basic knowledge and skills of computer use are on the rise, there will be many patrons who will get their first exposure to computers and networks in the library. The need for computer literacy as well as information literacy has serious implications for the content of any library instruction program that supports the use of a collection of networked information.

IMPLEMENTATION

Since May 1991, Mann Library has been providing our community of Cornell University students, faculty, and staff with campus network access to a collection

of networked information resources stored locally at the library and remotely at other institutions connected to the Internet. The integration of networked information into library services has been a measured process of systematic research and strategic planning. Over the past decade, Mann Library has pursued an aggressive program of automation to introduce computing technologies into all aspects of library operation and services. These efforts have resulted in the development of new facilities, services, and staff expertise that formed a crucial foundation for the integration of networked information resources into the library's collection.

Changes in Organization, Facilities, and Services

In 1984, the Mann Library opened the first microcomputer center on the Cornell campus (Curtis, 1987). Its purpose was to provide a comprehensive information literacy program as well as public access to information technologies and electronic information resources. While at the library, patrons can make use of word processing, spreadsheet, and database management software. The microcenter's workstations are connected to a local network that has access to the campus network and the Internet. Faculty, staff, and students can access a variety of networked information resources and services from the microcomputer center including electronic mail, Gopher, File Transfer Protocol (FTP), terminal-based information services on the Internet, and local information resources such as the Cornell Libraries Online Catalog and Mann Library's collection of bibliographic and numeric databases.

In conjunction with the development of the microcomputer center, the library added two full-time staff dedicated to computing support and operation of the microcomputer center. In 1986, these staff formed the basis of a new unit in Mann Library known as the Information Technology Section (ITS) (Curtis, 1987, p. 13). The ITS serves as Mann Library's computing systems group, analogous in organizational function to the management information systems (MIS) departments found in corporations whose operations have become highly automated. The role of the ITS includes introduction and support of information technology throughout the library, staff and patron instruction, and participation in library research projects. Since its formation, the ITS has expanded in size to a staff of six full-time computer professionals, with expertise in microcomputer hardware and software support, local area networking, software development, UNIX computer systems management, and user interface design.

With the opening of our microcomputer facility, Mann Library expanded its instruction program beyond traditional bibliographic instruction into areas related to the handling of digitally formatted, electronically stored information. Today, the library's instruction program includes workshops in basic microcomputer skills, end-user searching of bibliographic and numeric databases accessible online and on compact disk, and the use of specific software applications for managing and manipulating information retrieved using a computer. An extensive treatment of our approach can be found in chapters 8-12 in Curtis (1987).

In 1987, Mann Library began integrating compact disk databases of bibliographic, statistical, and textual data into the library services (Barnes &

Spragg, 1990; Coons & Stewart, 1988). Today, a second microcomputer facility of dedicated compact disk workstations has been established in the reference area of the library.

Experimentation with Networked Information

In 1987, Mann Library also began a series of research projects to investigate the issues surrounding the integration of network-accessible, scholarly information resources into the library's collection and services. The underlying theme of this research program was the development of the scholarly information system (Olsen, 1990, p. 222), which was envisioned to consist of four components: first, scholars at workstations in their homes, laboratories, classrooms, or offices; second, computer networks of campus, regional, national, and global scope; third, electronic information resources located on computers throughout the world and accessible via the networks; and, fourth, the campus library, providing scholars with organized access to and assistance with the growing collection of scholarly networked information.

The broad goals of these projects have been to identify and assess the organizational, technical, service, and marketing issues that arise in support of a collection of networked information resources. Individually, the projects focused on research and experimentation with local storage of networked bibliographic, numeric, and textual information, and with mechanisms for providing scholars with access to a collection of these genres of information.

Mann Library's initial research project involved maintaining locally stored bibliographic databases for network access. In collaboration with Cornell Information Technologies (CIT) and with contributions from the National Agriculture Library, Biosciences Information Service (BIOSIS), and BRS Information Technologies, Mann Library developed the "Scholars' Information System." Using a campus minicomputer maintained by CIT, we acquired the BRS/Search database management software and mounted four bibliographic databases in the disciplines of agriculture and biological sciences. Access to the Scholars' Information System was offered as an experimental service for two years to a group of approximately 200 Cornell faculty and staff who had agreed to participate in the project. Workshops in bibliographic database searching were developed by library staff and offered to all participants. Reference and technical support was provided via telephone and electronic mail by library staff members of the project team. We gained valuable experience in the acquisition of files from database producers and techniques for locally loading databases for network access. We began to identify the desirable hardware and software configurations of the remote users' microcomputer and their instructional needs in using networked bibliographic databases. We also learned that our community of scholars was eager for network access to the library's information resources.

In 1989, Mann Library received a grant from the U.S. Department of Education to investigate the local mounting of numeric databases for network access. Two large datasets produced by the federal government were loaded on a networked minicomputer acquired by the library using Informix/SQL database software. To investigate functional requirements of a system for

interacting with numeric data and user interface design issues, library staff on the project developed a custom information retrieval program for the two locally mounted datasets. The library gained experience from this project in large-scale software development, user interface design, and the identification of the unique requirements of database design for numeric datasets.

We are currently engaged in a research project to investigate the provision of networked access to digitally stored full text. This project is known as the Chemistry Online Retrieval Experiment (CORE). Mann Library is collaborating with the American Chemical Society, OCLC, and Bell Communications Research (Bellcore) to test a variety of prototype information systems for the search, retrieval, and delivery of the full-text and page images of core journals in the discipline of chemistry. Within this collaborative project, a primary objective of Mann Library is to investigate the manner in which scholars will make use of full-text journal literature that is readily accessible from networked computers on their desktops.

Building on previous experiences, our next research project was directed at determining the requirements for presenting, maintaining, and supporting a collection of networked information resources. In 1989, Mann Library received a three-year grant from Cornell University's President's Fund for Educational Initiatives to integrate the use of information technology and networked information resources into the curriculum of undergraduate students in the biological sciences. In collaboration with faculty in Cornell's Division of Biological Sciences, we pursued four objectives: first, to mount locally a collection of networked information resources relevant to scholarship in the biological sciences; second, to upgrade selected campus microcomputer centers with connections to the campus network in order to provide students with public access to appropriate information technologies; third, to develop a gateway system to provide organized and convenient access to the library's collection of networked information; and, fourth, to establish a working relationship between library staff and teaching faculty in order to provide students in the biological sciences with integrated instruction in computer and information literacy skills.

With regard to integrating networked information into library services, the creation of the gateway system was a critical element in Mann Library's effort. Known simply as the Mann Library Gateway, this system provided the library with a vehicle for presenting and providing organized access to its heterogeneous collection of networked information resources, regardless of what kind of information they contained, or whether they were stored locally or at other institutions. For our networked patrons, the Mann Library Gateway represents a virtual extension of the library into the milieu of information services that give definition to the local cyberspace of Cornell's campus network.

The design of the Mann Library Gateway was guided by four criteria. First, the system had to be accessible from Macintosh and IBM-compatible computers. At the time of development, a survey of patrons revealed a nearly 50-50 split between use of the two microcomputer platforms and that nearly all were using telecommunications software that emulated the ubiquitous character-based DEC VT100 terminal to connect to remote computer systems. Second, the Gateway had to present the library's collection of networked

information in a clearly organized and convenient manner. We wanted our networked patrons to be able to quickly locate and use a database in our collection without the need to remember the arbitrary logon protocols typically required to access networked computer systems. Third, the Gateway had to provide descriptive information about each database in the collection to permit the networked patron to select the items relevant to his or her information need. Many gateway systems present only a list of titles. With names like AGRICOLA, BIOSIS Previews, or RLIN, it can be difficult for patrons to decide which information resource will be relevant and useful. Finally, the Gateway had to clearly communicate how and from where the networked patron could get assistance in using databases in the library's networked collection. It was important to convey to the users of the Gateway that they had network access not only to the library's collection of databases but also to its staff for questions and problems. Figures 1 and 2 depict the catalog and closing screens developed for the Gateway system.

Mann Library Gateway	
Databases _____	Description _____
1. ABI/Inform	
2. AGRICOLA	AGRICOLA is a database of citations and abstracts to literature in agriculture and related subjects.
3. BIOSIS	
4. CARL Uncover	
5. Cornell Online Catalog	Articles are indexed from 5000 journals and other serials. Books, conference proceedings, research reports, theses, patents, software, and government documents are also indexed.
6. Crop Estimates-County File	
7. ERIC	
8. Nat'l Resources Inventory	
9. RLIN	
	Source: National Agriculture Library Coverage: 1982-present Updated: Monthly
Directions _____	
To: Highlight a resource	- type its number or use arrow keys.
Connect to a resource	- highlight it and press RETURN .
Change your password	- type p .
Quit the Gateway	- type q .

Figure 1. Catalog screen from the Mann Library Gateway

With the successful development of the Gateway, Mann Library had made significant progress toward realizing an integrated collection of networked information resources. It had established an initial collection of networked information resources, had developed a mechanism for presenting and providing access to that networked collection, and had identified the reference and technical support services that networked patrons considered important. This project also provided the library with a valuable opportunity to consider a number of models for mainstreaming the support of networked information into our existing library organization. By the end of the project in 1992, Mann Library was ready to begin the formal integration of its collection of networked information resources into library services.

Mann Library Gateway

Problems? Questions? Comments?

If you had any questions or problems using the Gateway, please let us know.

By phone:
Call 255-5406,
Mann Reference Desk,
Mon-Fri, 8am - 10pm.

By electronic mail:
Send a message anytime to
manx@cornellc.bitnet.

Mann Library will continue to improve and expand the Gateway. We welcome your input.

If you have any comments regarding Gateway or suggestions for new features, please contact us.

Thanks!

Press **RETURN** to continue

Figure 2. Closing screen from the Mann Library Gateway

INTEGRATING NETWORKED INFORMATION INTO LIBRARY SERVICES

In our approach to this challenge, Mann Library has considered it important to have participation from staff in all units of the library. We have emphasized participation through group discussions of the issues surrounding networked information and through projects in which library units have been encouraged to experiment to find ways to accommodate this new medium. Our success with providing the community with access to a collection of networked information has been the direct result of a team effort by the entire library organization to absorb and apply the knowledge, skills, and experiences gained from its research projects.

Technological Requirements for Networked Information

Our current collection of networked information consists of 11 resources comprised of bibliographic, statistical, and textual databases, and a table of contents service. At present, the majority of Mann Library's collection of networked information is stored locally on computers at the library: ABI/Inform, AGRICOLA, BIOSIS Previews, Census of Population and Housing, ERIC, National Resources Inventory, and USDA Crop Estimates. CARL UnCover and RLIN (Research Libraries Information Network) are examples of networked information resources for which access for the Cornell community has been obtained through contracts with other institutions on the network. The Cornell Libraries Online Catalog and CLIMOD are examples of networked information resources that are locally maintained by other organizations at Cornell for which we provide access through the library's Gateway.

To support our locally stored networked information resources, Mann Library currently manages four UNIX-based multiuser computers. One computer supports the Gateway system and serves as the main entry point for patrons to our collection of networked information. A second computer is used as a server for three numeric databases. Informix/SQL and the University of Minnesota's Gopher software are used as the access software. Four bibliographic databases are split across the remaining two servers. BRS/Search full-text search and retrieval software is used as the access software. Each of the library's four server computers has several gigabytes of hard disk storage and is connected through a local area Ethernet network in the library to the Cornell campus network and, subsequently, to the global Internet. Access to the remotely stored information resources in the collection is provided through the Gateway system using the UNIX Telnet and tn3270 programs. In addition to the local database servers, all Mann Library staff have a networked microcomputer at their desk or work area through which they can access the library's collection of networked information and provide services in support of it. Management and maintenance of the database servers and staff computers is performed by the library's Information Technology Section.

Facilities for Storage and Access of Networked Information

To house the library's database servers and associated storage devices, a room within the Mann Library building has been converted for use as a "machine room." The machine room is secured from public access and is environmentally controlled for electrical power supply, temperature, and humidity. As our locally stored collection of networked information grows, this facility will likely be expanded.

Mann Library's microcomputer center serves our patrons with public access to networked microcomputers. Additional networked microcomputers have been placed in the CD-ROM access microcomputer facility within the library's reference area. Cornell's campus computing organization and several individual colleges and departments also maintain public access microcomputer facilities in various locations around the campus. Campus network access in dormitory rooms, offices, and laboratories and dial-in access from off-campus residences also permit private access to our collection of networked information.

Staff Knowledge and Skills for Networked Information

Maintaining and supporting the library's collection of networked information resources has had the most impact to date on our public services and computing systems staff. Reference librarians, information assistants, and technical support staff have had to acquire a great deal of technical knowledge regarding communications software in a variety of microcomputer environments. As Sally Kalin has noted, "telecommunications set-up and troubleshooting is the most heavily demanded service requested by remote access users" (cited in Peters, 1991, p. 164). Staff in the library's Public Services Division have learned to operate eight communications software programs for Macintosh and IBM-compatible computers that are commonly used with Cornell's campus

computer networks. Knowledge of local campus networking and the Internet has also been necessary to assist patrons in troubleshooting problems in connecting to the library's Gateway computer.

Training in the technical knowledge needed to support the collection of networked information was provided by the library's ITS and by members of the various project teams through a series of workshops. These workshops covered campus networking and the Internet, introductions to the variety of networked information resources available, and the communications programs and other tools used to locate and access them.

The development of Mann Library's Gateway and its collection of networked information resources required changes in library staffing. In addition to training existing staff, the library has acquired new personnel and reoriented existing positions with a focus on digitally formatted information resources. Staff expertise in user interface design, the development of networked information systems, and the handling of electronically published information was considered critical by the library's director in pursuing the integration of networked information into the collection. Four new staff have been added to the library's computing systems unit, bringing skills in user interface design, network management, large-scale software development, and administration of UNIX-based computer systems. Staff have also been added to the public services and technical services units, including a specialist in numeric information, an electronic resources cataloger, and a coordinator of public access computing facilities. A more complete discussion of administrative and staffing issues can be found in Olsen (1990, pp. 238-240).

User Instruction for Networked Information

Instruction in the access and use of the library's collection of networked information has been integrated into our regular instruction program. A series of workshops is given every semester and during intersessions by staff instructors in the basic use of a microcomputer, communications software, specific networked information resources in the collection, and information processing and management applications such as spreadsheets, word processors, and personal reference managers. Schedules of our workshops are mailed to faculty in our constituent colleges before each semester begins to allow them time to consider integrating our instruction into their courses.

We have found that our patrons work in a variety of personal computing environments and with a range of levels of computer and information literacy. To accommodate this, we have expanded our instruction program to include hands-on workshops on both Macintosh and IBM-compatible computers. To assist the self-directed patron who avoids formal workshops, a selection of short documentation and reference sheets has been created by library staff. These include guides to searching the databases in the collection, "quick guides" to configuring the selection of library-supported communications packages, and a comparative guide to assist patrons in selecting an appropriate communications program for their personal computing environment.

As an adjunct to our regular instruction program, Mann Library staff have also conducted a series of marketing presentations at college and departmental

faculty meetings. These presentations have been designed to introduce the faculty in the community to the library's collection of networked information and to encourage them to consider how its use could be integrated into their own research and instruction. These presentations, which have included a hands-on introduction to the Gateway and databases in the collection, have been instrumental in getting many faculty "back into the library" through personal use of the library's electronic resources.

Adapting the Practices of Librarianship to Networked Information

Public Services

For providing assistance and reference service for the collection of networked information, our Public Services staff use a mix of old and new techniques. The reference interview is most often conducted over the phone or through electronic mail. Conducting the interview, with regard to a networked information resource in the collection, is complicated by the need to determine the context of a patron's local computing environment as well as the context of the information need. Staff increasingly answer questions revolving around technical support such as reports of forgotten passwords on personal Gateway accounts, procedures for connecting to the Gateway, and methods for downloading information retrieved from a database search.

Our patrons have also been looking to library staff for advice and assistance in selecting software for use with our networked collection. Two common questions concern evaluating which communications and personal reference management software packages are the best for use with our collection of networked information resources. With personal computers becoming more integral to the use of scholarly information retrieved from the library, patrons will naturally come to expect this kind of consulting service from library staff. This situation has presented us with a dilemma. On one hand, public services librarians have traditionally been wary of providing any potentially biasing opinion regarding information sources and this naturally extends towards the evaluation of particular software programs. On the other hand, to encourage and facilitate the use of information technology and networked information resources, it is in the best interests of the library to recommend the use of software that is known to work well with its collection of networked information. In the case of communications software, which is a critical component of any scholars' information system, a program that is difficult to use or lacking in relevant features can negatively taint a patron's experience with the library's collection. It is good service and good marketing to recommend the use of particular software programs that work effectively and will leave the networked patron with a positive impression of the library's services. We are presently experimenting with a limited form of this consulting service by conducting demonstrations of communications and reference management software available to the local Cornell community and by providing comparative evaluations of the programs based on the features available in each. As we have gained working experience with several of the available programs,

we have become more confident in being able to recommend some over the others. However, the scope to which this kind of consulting service should be implemented by the library remains to be explored.

Collection Development

The identification and selection of networked information resources at Mann Library is performed by an internal collection development body known as the Electronic Resources Council (ERC). The ERC is chaired by the library's head of collection development and is comprised of representatives from acquisitions, public services, and the computing systems group, as well as selectors from all units in the library with expertise in particular genres of electronic information (e.g., bibliographic, numeric, textual, and government documents). The ERC evaluates electronic information resources for acquisition using traditional selection criteria, such as subject coverage and currency, as well as additional attributes that are unique to digital formats, such as medium of publication (e.g., network or compact disk), technologies required for storage and access, contractual or licensing restrictions on access, and desired level of reference support.

Mann Library's Collection Development Division has also formed a group known as the "Internet Prospectors" who are surveying the Internet for networked information of relevance to the library's subject areas of collection. This group has identified locations of networked archives and servers with information in the library's subject areas and developed a working knowledge of the various tools used for accessing and retrieving Internet resources.

Technical Services

The acquisition of networked information resources is handled by the acquisitions staff in the library's Technical Services Division. At this time, acquiring the data files for a database to be locally mounted or obtaining accounts and passwords for access to remotely stored information resources requires much negotiation. Commercial producers of databases are still in the process of developing suitable policies for the licensing of data files to libraries. Providers of networked information services are also in a transitional period in which they are developing new policies and pricing schemes for allowing remote access to their information resources. We have found that much individual negotiation has been required with each database producer or access provider to acquire a networked information resource for the collection. "Standard terms" under which libraries can acquire data files for local storage or access to networked information services are still evolving, which makes this task a continual challenge for the acquisitions staff. As the acquisition of networked information becomes a more common activity in libraries, we are confident that standard terms will be established that accommodate the library's traditional mission of collection, preservation, and access to information.

The cataloging of our growing collection of networked information resources has presented us with a particularly vexing problem. Our present collection is so small that a virtual analog to the traditional book catalog has been sufficient to facilitate access for our networked patrons. Mann Library's Gateway system presents an alphabetical list of titles accompanied by short

descriptions of each of the networked databases in the collection. Over the next year, we anticipate that our collection will grow into the hundreds. The book catalog model will quickly become unworkable.

A logical place to catalog the virtual holdings of a university library's networked information collection would appear to be its current online catalog. However, the procedures and policies surrounding the construction of the online library catalog have been based upon the existence of scholarly information resources as physical objects with physical library locations. Networked information resources are not easily accommodated in the existing systems. As illustrated by the OCLC Internet Resources study (Dillon, Jul, Burge, & Hickey, 1993), the USMARC record also presents some challenges for accommodating the description of networked information resources.

Staff from the library's cataloging, reference, and computing systems units are currently engaged in a project to develop a network-accessible catalog of the Mann Library's collection of electronic information resources that addresses the unique features of these new formats. This catalog will include not only networked information but also resources in our collection that are stored and accessed on compact disks, diskettes, and magnetic tapes. We are exploring several questions regarding the cataloging of networked and other electronic information resources, including how public services and cataloging staff can work together to provide descriptions of resources, what data elements are important to include in those descriptions for patron use and the library staff needs, and how the accuracy of cataloging records can be maintained for networked information resources whose content can change dynamically and without warning.

FUTURE PLANS

Our future plans for development of our virtual library include expanding our collection of network-accessible information resources, refining the user interfaces to those resources, and making more of the library's traditional services accessible via the campus network. Since the original design of the Mann Library Gateway, a number of developments have occurred in Cornell's computing and networking environment and in the world of networked information. Over the past two years, use of the campus network has become more pervasive among Cornell's faculty, staff, and students. The university's central computing organization has been actively moving its campus information services such as electronic mail and the campus-wide information system from its two campus mainframe computers to smaller UNIX-based computers. The use of terminal emulation programs to access networked information services has given way to other microcomputer-based programs providing user interfaces that take better advantage of the microcomputer's display, processing, and storage capabilities. In the world of the Internet, information publication and retrieval systems based on the client-server computing model, such as Gopher, Wide Area Information Servers (WAIS), and World Wide Web, are widening the possibilities for providing the networked community with digitally formatted information. The continuing development and acceptance of the Z39.50 standard information retrieval protocol will make it possible for people to access a wide

variety of different types of networked information resources through a few consistently designed user interfaces.

Over the next two years, Mann Library will be reengineering its Gateway system to follow the recent developments in client-server software and standardized information retrieval protocols. We intend to develop microcomputer-based software following the client-server model that provides direct access to a catalog of our networked information collection, and to the networked resources themselves, using the Z39.50 protocol.

We will also explore other standardized networked information services such as Gopher, WAIS, FTP, and Network News to translate other library services into the networked environment. In particular, we will experiment with providing access through the campus network to documentation, instructional materials, and reference and technical support staff. Interlibrary loan, current awareness services, document delivery, and reserve services are also targets for transition to networked library services.

We intend to expand our collection with the addition of more locally and remotely stored networked information resources. An upcoming project will be exploring ways in which networked information can be provided to the Cornell community in a convenient and cost-effective manner through commercial information providers such as DIALOG and BRS. In addition, we will begin identifying and selecting networked information published on the Internet via Gopher, WAIS, and FTP for inclusion in our virtual collection. The library has recently begun experimenting with these network publishing tools for our own local loading of information resources. We currently have mounted datasets from the 1990 U.S. Census of Population and Housing for campus network access using a locally maintained Gopher server. We are also exploring the use of Gopher, WAIS, and BRS/Search to mount selected electronic journals.

CONCLUSION

Just as use of a large collection of books is made possible by a building and shelves in which to put them, a cataloguing system, borrowing policies, and reference librarians to assist users, so the use of a collection of computers and computer networks is supported by the existence of institutions, services, policies, and experts—in short, by an infrastructure. (Panel on Information Technology and the Conduct of Research, cited in Duncan, 1993, p. 54)

The emergence over the last decade of powerful personal computers, computer networks, and networked information has triggered a revolution and an evolution in the academic community. The infrastructure supporting the pursuit of scholarship, once a stable and well-established system, is now in a state of transformation. Visibility and technical competence are identified by Post and Sessions as two factors of importance for the academic library in maintaining its role in the changing information environment of the academic community (cited in Martin, 1992, p. 79). Visibility is defined as "the extent to which the library is perceived as an information facility." Technical competence is defined as "the extent to which the library is prepared, and

is perceived to be prepared, to provide current and future information services." Through the pursuit of research projects and the provision of innovative services in the use of microcomputers and networked information, Mann Library has attempted to address these factors in a positive way. We hope that our successful efforts and those of other institutions to integrate networked information into library services will serve as evidence that the academic library can continue to play its critical and unique role in the academic community.

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